



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/595,434	04/19/2006	Siegfried F. Karg	CH920030009US1	9566
32074 7590 04/21/2011 INTERNATIONAL BUSINESS MACHINES CORPORATION DEPT. 18G BLDG. 321-482 2070 ROUTE 52 HOPEWELL JUNCTION, NY 12533				
EXAMINER HORNING, JOEL G				
ART UNIT		PAPER NUMBER		
1712				
NOTIFICATION DATE		DELIVERY MODE		
04/21/2011		ELECTRONIC		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

EFIPLAW@US.IBM.COM

Office Action Summary

Application No.

10/595,434

Applicant(s)

KARG ET AL.

Examiner

JOEL G. HORNING

Art Unit

1712

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 March 2011.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 10-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB-08)
Paper No(s)/Mail Date 03-10-2011
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
1. **Claims 10-14 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Uesugi (US 4873413) in view of Jersch (Applied Physics A **66**, 29-34 (1998)).

Uesugi teaches a method for direct writing a layer of material onto a substrate by focusing a laser beam to intensify it on a substrate; locally heating the substrate in the presence of a vapor of a precursor to the material, causing the thermal decomposition of the precursor vapor and deposition of the material in that localized region. The focused laser beam is then scanned over the substrate in order to form a predetermined pattern of the deposited material (col 1, lines 14-34, figure).

Uesugi teaches using a lens to focus the laser, not an AFM probe tip.

Jersch is also directed towards using a focused laser to heat a substrate, so the surface can be modified (abstract). However, Jersch teaches it is possible to focus and intensify the light onto the substrate and scan it in a desired pattern by a so called FOLANT technique which utilizes scanning force microscope tips. From figure 2 and the description of the SFM (scanning force microscopy) tip, it can be considered an atomic force microscopy tip (section 2, experimental evidence of field enhancement). Jersch further teaches that the resulting enhancement is found in the electromagnetic near field to the tip and that surface plasmon resonance produced at the tip is one of the reasons for the intensification of the field (section 1, field enhancement of laser irradiated SPM tips).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use the FOLANT technique with an AFM tip, as taught by Jersch, to focus the laser (**claim 14**) at the surface of the substrate to get the necessary intensity there so that the material vapor between the tip and the substrate will decompose, instead of using the lens taught by Uesugi, since it was another known method for focusing a laser beam onto a substrate for the purposes of surface modification, which would be expected to produce predictable results.

Since the AFM tip is intensifying the light from the beam so that it is only strong enough to decompose the vapor, it is readily apparent that the light beam itself would not be strong enough to decompose the vapor, even at the tip, otherwise, the decomposition would not only occur locally (making patterning less

effective), and making the AFM intensification superfluous to the process, since it would not control where the deposition occurs (**claim 10**).

2. Regarding **claim 11**, Uesugi teaches using WF_6 as the precursor vapor (col 10, lines 16-20).
3. Regarding **claim 12**, Jersch teaches that the laser beam polarization should be parallel to the long (longitudinal) axis of the probe (section 2, experimental evidence of field enhancement).
4. Regarding **claim 13**, Jersch teaches that the field enhancement (amplification) of the light due to the FOLANT a function of the wavelength (optical frequency " ω ") of the laser light used (see equations 1 and 2) and that it even affects the mechanism by which the field enhancement occurs (plasmon resonance only occurs with certain materials and for certain wavelengths, section 1, Field enhancement of laser irradiated SPM tips).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to control the laser frequency in order to produce the desired amplification level to decompose the precursor vapor with the probe tip used since it was a variable which was known to affect the amplification level and would produce predictable results. Since the probe tip has a size, the wavelength of the light is adapted to match the size of the probe tip used (**claim 13**).

5. Regarding **claim 16**, Jersch further teaches coating the tip with metal, such as gold or silver in order to improve the enhancement factor of the probe tip and produce

better mechanical properties (section 1, Field enhancement of laser irradiated SPM tips).

6. **Claim 15** is rejected under 35 U.S.C. 103(a) as being unpatentable over Uesugi (US 4873413) in view of Jersch (Applied Physics A **66**, 29-34 (1998)) as applied to claim 10, further in view of Mirkin et al (US 20020063212).

Uesugi in view of Jersch does not teach using multiple probe tips at the same time for the deposition process.

However, Mirkin et al is also directed towards a process of depositing layers of material using AFM tips as the deposition source (abstract). It teaches using multiple AFM tip arrays for the deposition process in order to enable depositing material from multiple tips simultaneously, resulting in a process where "both imaging and patterning speeds could be dramatically improved" [0185].

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use multiple tips at the same time in order to dramatically improve the patterning speed of the process (**claim 15**).

Response to Arguments

7. Applicant's arguments with respect to claims 10-16 have been considered but are not convincing.
8. Applicant first argues that the electromagnetic near field intensified light is not indicated by the art to be suitable for decomposing gas. However, the art indicates that in order to decompose the gas, the light needs to supply an appropriate amount of energy to the gas in order to heat it to decomposition (Uesugi, col 3, lines 50-56).

The FOLANT intensified light is light, so it is suitable for decomposing gases, as long as it has an appropriate intensity such that it will heat the gas to decomposition. A practitioner would recognize that the laser intensity irradiating the AFM tip would be chosen so that when intensified by the AFM tip, it will be sufficient to decompose the vapor and it would be appropriate for CVD.

9. Whether the intensity of the light is increased in the near-field or the far-field it produces the same effect of intensifying the light. The relative strengths of the fields and light produced will vary based upon several factors such as how much the laser is intensified by either. A practitioner can simply determine the conditions for each that will be sufficient to decompose the vapor of choice.
10. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).
11. Regarding applicant's argument that using the laser beam to cause thermal decomposition of the precursor is contrary to what is claimed in claims 1, 13 and 20, the examiner does not see any requirement for non-thermal decomposition of the vapor in claim 13 and claims 1 and 20 are not present in the current claim set. As a

result of such a limitation not being present, such a determination is not dispositive to the case at this time.

12. Applicant argues that there is no material support for using an intensity of a laser beam that is not strong enough to decompose the gas. However, Uesugi uses a laser beam that is focused so that the laser intensity is increasing at the light approaches the substrate so that decomposition occurs at the substrate, not everywhere in the chamber (col 1, lines 25-35). Likewise, Jersch uses a laser that is not intense enough to modify the substrate everywhere, but only where the FOLANT focusing method is being used. That is how it patterns the surface; otherwise the entire surface would be changed. The idea is present in both.
13. Applicant then argues that to accept that to use a laser beam in Uesugi that is not sufficiently intense to decompose the vapor would indicate that Uesugi is not operable. The examiner disagrees. Uesugi (like Jersch) is focusing light. The light used is intense enough when it is focused, but not where it is not focused. Uesugi teaches focusing the light on the substrate so that on the surface it is sufficient to decompose the vapor, but the laser is much less intense away from the substrate, so it does not decompose the gas there. Likewise Jersch focuses light (using FOLANT) so that it is sufficiently intense at the substrate to modify the surface, but only where it is focused, not everywhere else. They both teach this limitation, but the method of intensifying the light where it is desired is different.

Conclusion

14. No current claims are allowed.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL G. HORNING whose telephone number is (571) 270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. G. H./
Examiner, Art Unit 1712

/David Turocy/
Primary Examiner, Art Unit 1717